UNCLASSIFIED

AD NUMBER
AD846684
NEW LIMITATION CHANGE
TO Approved for public release, distribution unlimited
FROM Distribution authorized to U.S. Gov't. agencies only; Administrative/Operational Use; DEC 1968. Other requests shall be referred to Naval Ordnance Laboratory, White Oak, MD.
AUTHORITY
USOOl ltr, 12 Dec 1972

THIS PAGE IS UNCLASSIFIED

ORD-9132

NOLTR 68-184

TR-68-184
C-1

AD-847648

COMPARISON OF THE UNDERWATER POWER OF EXPLOSIVES IN SMALL CHARGES
XII. THE EFFECT OF PARTICLE SIZE AND DENSITY ON THE PERFORMANCE OF COMPOSITE EXPLOSIVES

2 DECEMBER 1968

NOL

UNITED STATES NAVAL ORDNANCE LABORATORY, WHITE OAK, MARYLAND

NOLTR 68-184

61

COMPARISON OF THE UNDERWATER POWER OF EXPLOSIVES IN SMALL CHARGES XII. THE EFFECT OF PARTICLE SIZE AND DENSITY ON THE PERFORMANCE OF COMPOSITE EXPLOSIVES

by

Thomas B. Heathcote

ABSTRACT: Three composite explosives pressed to several densities and boostered with truncated cones of pressed pentolite were used to study the effects of particle size and density on the explosive output from one lb. charges. Finely divided ammonium perchlorate (AP) was used in one type of AP/TNT/Al(45/20/35) mixture; these exhibited shock wave and bubble performance independent of charge density. AP/TNT/Al charges utilizing a coarse AP component showed a tendency toward decreased shock wave energy output as the density decreased. Charges of TNT/Al/Wax(55/40/5) gave greater shock wave output than was estimated for large charges of the same composition.

UNDERWATER EXPLOSIONS DIVISION
EXPLOSIONS RESEARCH DEPARTMENT
U.S. NAVAL ORDNANCE LABORATORY
White Oak, Silver Spring, Maryland

NOLTR 68-184 2 December 1968

COMPARISON OF THE UNDERWATER POWER OF EXPLOSIVES IN SMALL CHARGES
XII. THE EFFECT OF PARTICLE SIZE AND DENSITY ON THE PERFORMANCE OF COMPOSITE EXPLOSIVES

The work described in this report is part of the Naval Ordnance Laboratory's continuing program of investigation of the underwater performance of explosive mixtures, conducted under ORD Task ORD-332-006/UF17-354-304. This study is a continuation of earlier work to establish a rapid, reliable, inexpensive method of assessing the underwater performance of small explosive charges. In this work, charges of relatively insensitive explosive mixtures were fired to better define the effect of particle size and density on the output of such compositions.

Mention of commercially available products represents neither an endorsement nor criticism by the Laboratory.

E. F. SCHREITER
Captain, USN
Commander

C. J. ARONSON
By direction

CONTENTS

ILLUSTRATIONS

TABLES

REFERENCES

(a) T. B. Heathcote, "Comparison of the Underwater Power of Explosives in Small Charges: VIII. A Study of Factors Affecting the Power of HBX-1 (U)", NOLTR 62-13, 2 Jan 1962, Confidential

(b) "Program Suggestions for Underwater Evaluation of Explosives in Small Charge Sizes (Report of XC Ad Hoc Committee) (U)", NOL Internal Report TN-6566, 20 Oct 1964, Confidential

(c) D. Price, C. R. Niffenegger and T. B. Heathcote, "Comparison of the Underwater Power of Explosives in Small Charges: X. Development of Improved Test Procedures (U)", NOLTR 66-73, 1 Jun 1966

(d) Thomas B. Heathcote, C. R. Niffenegger, "Comparison of the Underwater Power of Explosives in Small Charges: XI. Further Development of Test Procedures (U), NOLTR 67-17, 3 Mar 1967

(e) C. R. Niffenegger, "Comparison of the Underwater Power of Explosives in Small Charges (U)", NAVORD Report 2922, 1 Jul 1953

1. INTRODUCTION

Evaluation of the underwater explosive power usually starts with the firing of one-pound charges. Comparative measurements using diaphragm gages are made which provide a measure of shock wave energy relative to a standard explosive such as pentolite or HBX-1. Relative bubble energies are also obtained from measured bubble periods. In order to obtain meaningful results, it is necessary that two conditions be strictly adhered to. First, it is essential that the primary (pentolite) and secondary (HBX-1) standards give consistent output from shot-to-shot and from test series to test series. Second, the experimental charges must be prepared and initiated such that steady-state reaction (detonation) occurs in the entire charge and that optimum energy output is obtained.

The failure to obtain full energy output was suggested by the inconsistent output observed over a number of years for small HBX-1 charges (Ref. (a)[1]). Additionally, the output of other experimental mixtures in small charges did not agree with that obtained with large charges of the same mixture (Ref. (b)). Improved experimental methods to obtain more reliable results in small charge testing were recommended as the result of a study made by an ad hoc committee (Ref. (b)). Among the recommendations were that pressed charges be used whenever possible instead of cast charges, and that truncated conical boosters be used.

Tests previously conducted using these recommendations included HBX-1 charges of densities ranging from 90-98% TMD[2] and several other aluminized explosives (Ref. (c)). Results indicated that steady-state reaction had occurred for HBX-1 and that it again exhibited its former power. In succeeding tests (Ref. (d)), the range of densities was extended to 85% TMD to see if there might be an optimum density for some of the more insensitive explosives tested, since an increase in output was noted with decreasing density. The work reported here was done as a further extension of the work reported in reference (d). Specifically, the density range for the AP/TNT/Al composition was extended to about 80% TMD and for the TNT/Al/Wax composition to about 70% TMD. Charges were also fired with different particle sizes of ammonium perchlorate (AP) to investigate the effect of this variable on energy output. The TNT/Al/Wax composition was also of interest as previous tests have indicated a possible charge size effect[3].

2. EXPERIMENTAL DETAILS

2.1 Charges

Two types of experimental compositions were used. They were TNT/Al/Wax (55/40/5) pressed to about 70, 74, 79, 86, 90, and 96% TMD and AP/TNT/Al pressed to densities of 80, 90, and 95% TMD. The charges were right cylinders and were boostered with 30 gm or 100 gm conical pressed pentolite boosters. Four charges of each density and each booster weight were fired. Total charge weight,

---

[1] References are listed on page iii.

[2] Theoretical Maximum Density.

[3] A charge size effect is the increase in output with increasing charge weight. It may be real, or it may be an apparent charge size effect resulting from the incomplete detonation of the smaller charge.

including booster, was about 1 lb (454 gm). In addition, four shots of each of four weights (227, 300, 454, and 600 gm) of pressed pentolite were fired as the conventional standard charges.

TNT/Al/Wax(55/40/5)

Results from the most recent tests (Ref. (d)) of this difficult-to-detonate composition indicated that it was possible to obtain relative shock wave energy values, W_{Dd}, that were analogous to values estimated[1] for large charges of the same composition providing the charges were pressed to about 85% TMD and boostered with truncated cones of pressed pentolite. Results from the same tests also showed a marked improvement in RBE for lower densities, but still significantly below the values estimated for the larger charges. It thus appeared there might be a charge size effect in the RBE. However, when plotted linearly as a function of TMD the RBE had not yet reached its maximum value at the lowest density. Therefore, in order to determine whether increased porosity would increase the RBE, charges of this composition over a wider range of densities were included in this firing program.

AP/TNT/Al(45/20/35)

Underwater explosive data from earlier tests with this mixture revealed what was thought to be a charge size effect. In those tests cylindrical pentolite boosters were used. In succeeding tests, (Ref. (c)) charges were pressed to 93% TMD and when boostered with truncated cones of pressed pentolite it appeared that any charge size effect was eliminated. Additional shots were fired (Ref. (d)) using conical boosters and the range of densities was increased to include charges pressed to 85, 90 and 95% TMD. These charges utilized ammonium perchlorate of significantly smaller particle size than that used in preceding tests and gave W_{Dd}'s higher than any observed previously for this composition. Therefore, for this test series a study of the ammonium perchlorate particle size effect on the energy output was included. This was accomplished by including charges prepared with N131 (50μ size) and charges with the coarser N119 (200μ size) AP. All other components were identical to those previously used in this composition. In addition, the range of densities was extended to include 80% TMD.

2.2 Equipment and Test Procedure

Four charges of each type were fired. All charges were initiated with U. S. Army Engineers Special Electric detonators.

Four diaphragm gages were used on each shot to obtain relative shock wave energies (W_{Dd}'s). The charges were located centrally in an 8-ft diameter steel ring with the charge and gage orientation being identical to that described in reference (e). Two 1/2-in. diameter piezoelectric gages were used to obtain bubble periods from which relative bubble energies were calculated. The shots were fired from the NOL barge at a 9-ft depth in from 18 to 25 feet of water.

---

[1] To the knowledge of the author, no large charges of TNT/Al/Wax(55/40/5) have been fired. The estimates referred to are based on extrapolation of results obtained with other TNT/Al/Wax mixtures.

3. RESULTS AND DISCUSSION

The relative shock wave and bubble energies were computed from the experimental data on the IBM 7090. All values were obtained relative to pressed pentolite (95% TMD), as outlined in reference (e). Values are shown, on an equal weight basis, in Table 1.

TNT/Al/Wax(55/40/5)

W_{Dd}'s in Table 1 and Figure 1 for a charge density of about 96% TMD are essentially the same as those reported in references(c) and (d). The RBE's for the 96% TMD charges are considerably lower as compared to those previously reported in references (c) and (d) for this insensitive composition. This probably is because of the sharp decrease observed between 90 and 96% TMD, so that a small density variation has a large effect on the RBE. These extremely low shock and bubble energies and the curves of Figure 1 indicate that this composition is not detonable at 96% TMD.

Values of W_{Dd} and RBE for charges pressed to 90% TMD are nearly identical to those appearing in reference (d) for the same mixture. The W_{Dd}'s for charges of 80 and 85% TMD are essentially identical near the maximum, and exceed the estimated value (0.68) for large charges by about 10 percent. RBE values continue to rise at 85% TMD and appear to peak at about 80% TMD. A decline occurs for both W_{Dd} and RBE when the TMD is decreased to 74% and this decline continues at 70% TMD.

There is little doubt that W_{Dd} of the large charges can be duplicated or exceeded by that of strongly shocked small charges of this composition. However, this does not necessarily mean a steady-state reaction took place. In this case, there is still an unresolved problem in that there is a slight but definite booster effect discernable for the RBE as well as the fact that the maximum value of RBE is still much smaller than that estimated for larger charges (1.77 vs 1.98). (No booster effect was found in the RBE of HBX-1 for small charges (Ref. (d)). It seems likely that this composition is not detonating in this small size even at the higher porosities although a very vigorous reaction certainly is taking place. The problem can only be resolved by studying the detonability of this composition, or by studying further the charge size effect on the output, or by carrying out both studies. It is also necessary to know the charge size effect on RBE for a charge which is known to be detonating properly.

AP/TNT/Al(45/20/35) - N131 AP

The W_{Dd}'s and RBE's for pressed charges prepared with the fine (50µ) ammonium perchlorate (shown in Table 1 and Figure 2) remain constant in the range 80 to 93% TMD. The W_{Dd} values appear to average about 5% higher than those reported in reference (d) for pressed compositions using a similar ammonium perchlorate. However, no particle size study of the two AP's was made and there could be a significant difference in their average particle size. RBE's are of the order of 6% higher than those obtained from the most recent tests but are significantly below the values obtained for large cast charges, (Ref. (c)), (2.26 vs 2.50). No statistically significant difference exists between the eight values obtained in this series for either W_{Dd} or RBE and there is no indication of a booster size effect. It is still to be established whether the difference in RBE is a true charge size effect or is caused by a different energy partition in the two tests.

AP/TNT/Al(45/20/35) - N119 AP

As shown in Table 1 and Figure 3, considerable scatter exists in values for both W_{Dd} and RBE for the charges utilizing the coarse (200µ) AP, and a trend of increasing output with increasing density is apparent. This indicates that detonation problems occurred for this composition; this is further indicated by a definite booster size effect for both parameters. It is quite possible that much of the scatter is caused by poor charges, since the large particle size makes it difficult to obtain a uniformly mixed explosive. It is thus evident that the smaller particle sized AP is distinctly preferable to t e larger in the preparation of charges to be evaluated in small sizes.

4. SUMMARY AND CONCLUSIONS

Maximum values of W_{Dd} and RBE for TNT/Al/Wax charges were attained when the charges were pressed to about 80% TMD. W_{Dd} values that are shown on Figure 1 to have reached their optimum output, exceed those values estimated for large charges of this composition for all densities with the exception of the highly compressed 96% TMD. The extended range of densities used in these tests made it possible to determine that the maximum RBE values for the overall scale tests had been reached (Figure 1). The maximum RBE value found for this mixture remained significantly below that estimated for large charges. However, where comparable, the RBE's for all densities agree with values from previous small charge tests. It thus appears that the values estimated for large charges of this composition may not be realistic.

From these data, it appears that for testing small charges with a heavy fuel content and low in oxidizer (such as the TNT/Al/Wax composition), the mixture must be pressed to densities between 75 and 85% TMD and detonated with pressed conical boosters of pentolite if maximum output is to be realized.

As was the case for tests reported in reference (d), the W_{Dd}'s and RBE's for the AP/TNT/Al composition using the finely divided (50µ) AP were independent of porosity. The AP/TNT/Al charges that utilized the coarse (200µ) AP showed considerable scatter, indicating they did not detonate properly. Data from these charges also showed a decrease in W_{Dd} with a decrease in density.

5. RECOMMENDATIONS

Continued use of truncated conical boosters of pressed pentolite should be encouraged.

Experimental charges should be tested at several densities. If a porosity effect on the results is found, it may arise from (a) problems of initiation and (b) problems of detonability (critical diameter). Such problems have to be resolved as they are discovered.

Whenever a composite explosive contains a component such as AP which reacts slowly, small charges should be prepared with that component in a small particle size.

Ten pound (or larger) charges of TNT/Al/Wax should be fired so that a realistic comparison of output with one-lb results can be made.

Tests should be conducted on critical diameter effect on small charges with emphasis on "difficult-to-initiate" compositions.

TABLE 1

CHARGE DATA AND RESULTS

Explosive	Density (gm/cc)	TMD* (%)	Booster Wt. (gms)	W_{Dd}(pent)	RBE(pent)
TNT/Al/Wax 55/40/5	1.79	95.7	30	0.50	0.63
	1.79	95.7	100	0.50	0.67
	1.69	90.0	30	0.72	1.48
	1.69	90.0	100	0.75	1.63
	[illegible]	85.7	30	0.79	1.65
	1.6[illegible]	85.7	100	0.81	1.76
	1.[illegible]	7[illegible].3	30	0.82	1.73
	1.[illegible]	79.3	100	0.79	1.79
	1.[illegible]	74.4	30	0.77	1.72
	1.[illegible]	74.4	100	0.78	1.79
	1.31	69.7	30	0.69	1.66
	1.31	69.7	100	0.74	1.75
N119 (200u) AP/TNT/Al 45/20/35	1.98	95.0	30	1.34	2.20
	1.[illegible]8	95.0	100	1.34	2.26
	1.87	89.9	30	1.21	2.20
	1.87	89.9	100	1.28	2.30
	1.77	85.0	30	1.15	2.17
	1.77	85.0	100	1.22	2.28
	1.66	79.9	30	0.99	1.98
	1.66	79.9	100	1.24	2.21
N131 (50u) AP/TNT/Al 45/20/35	1.96	94.0	30	1.29	2.21
	1.96	94.0	100	1.26	2.32
	1.86	89.95	30	1.30	2.29
	1.86	89.95	100	1.36	2.27
	1.76	84.6	30	1.27	2.23
	1.76	84.6	100	1.33	2.29
	1.66	79.4	30	1.26	2.25
	1.66	79.4	100	1.35	2.25

*Theoretical Maximum Density of TNT/Al/Wax(55/40/5) is 1.88 gm/cm^3. TMD of AP/TNT/Al(45/20/35) is 2.06 gm/cm^3.

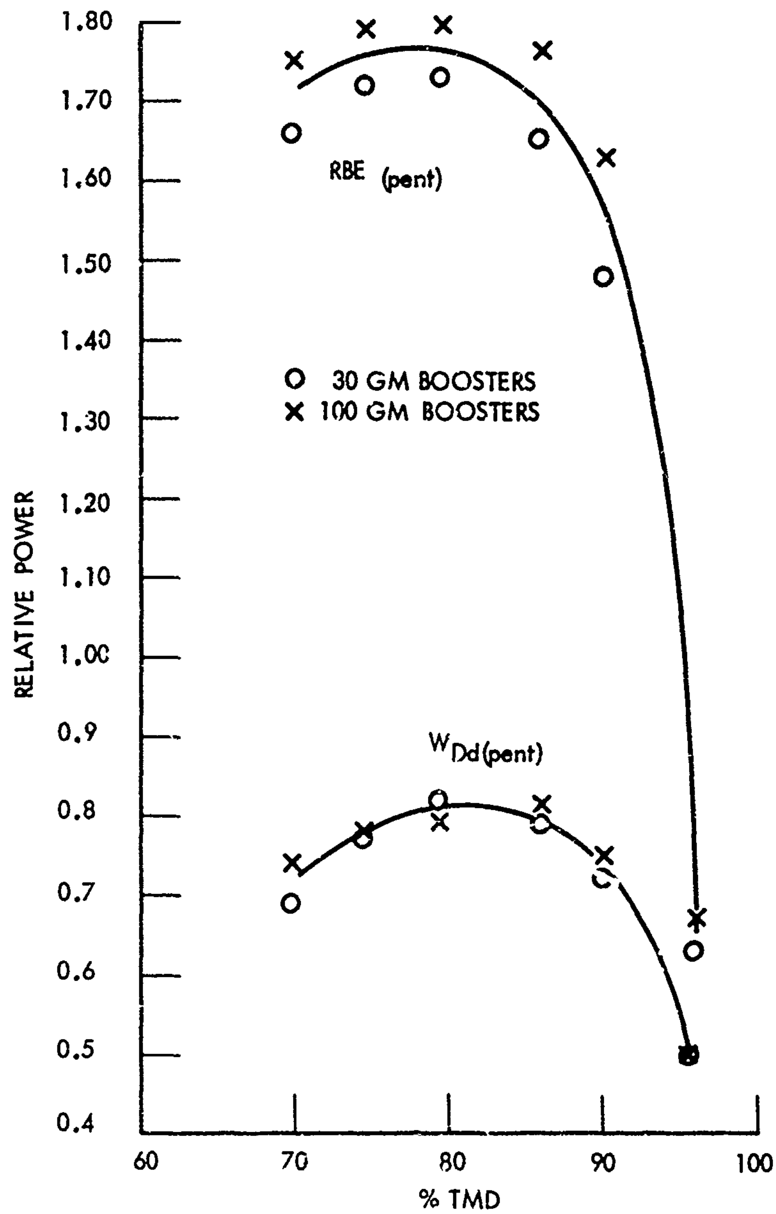

FIG. 1 THE EFFECT OF CHARGE DENSITY ON THE UNDERWATER POWER OF SMALL CYLINDERS OF TNT/Al/WAX; 55/40/5

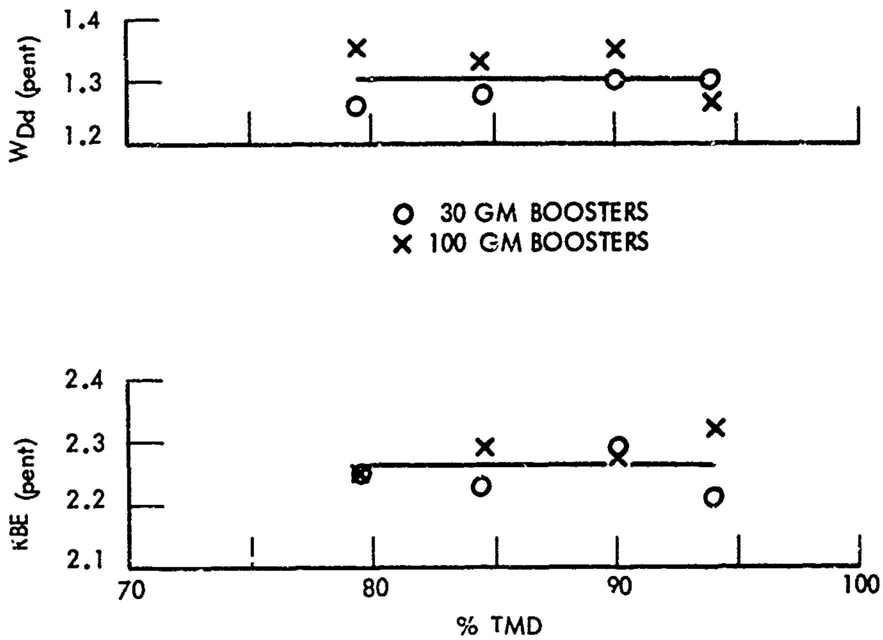

FIG. 2 THE EFFECT OF CHARGE DENSITY ON THE UNDERWATER POWER OF SMALL CYLINDERS OF AP/TNT/Al; 45/20/35 (50 μ AP)

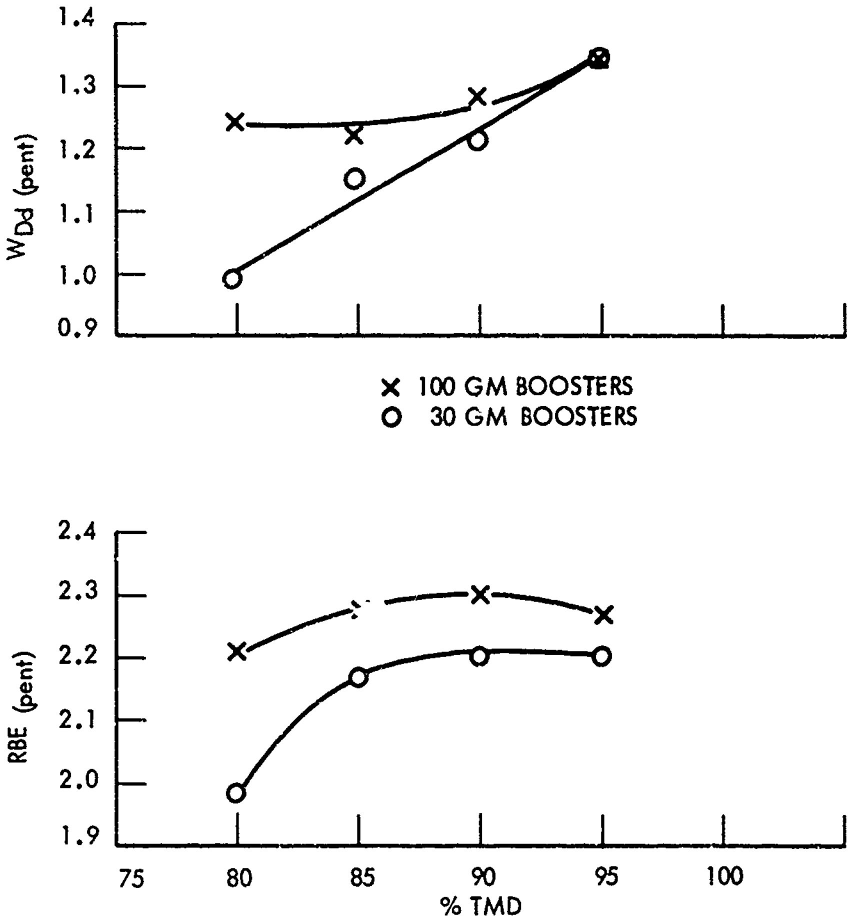

FIG. 3 THE EFFECT OF CHARGE DENSITY ON THE UNDERWATER POWER OF SMALL CYLINDERS OF AP/TNT/Al; 45/20/35 (200 μ AP)

DISTRIBUTION LIST

	Copies
Chief of Naval Operations	
Washington, D. C. 20360	
Attn: Op-75	1
Op-03	1
Chief of Naval Research	
Washington, D. C. 20360	
Attn: Code 408	1
Code 418	1
Code 466	1
Code 468	1
Commander	
Naval Ordnance Systems Command	
Washington, D. C. 20360	
Attn: ORD-033	1
ORD-034A	1
ORD-035	1
ORD-054111	2
ORD-05411	1
ORD-9132	2
Commander	
Naval Ships Systems Command	
Washington, D. C. 20360	
Attn: NADSC-6423	2
Commander	
Naval Facilities Engineering Command	
Washington, D. C. 20360	1
Commanding Officer	
U. S. Naval Radiological Defense Laboratory	
San Francisco, California 94135	
Attn: Code 222	1
Code 911	1
Code 934	1
Code 908	1
Commanding Officer	
U. S. Naval Ordnance Station	
Indian Head, Maryland 20640	
Attn: Library Division	1
Commanding Officer	
U. S. Naval Explosive Ordnance Disposal Facility	
Indian Head, Maryland 20640	
Attn: Library Division	1
Commander	
Naval Weapons Laboratory	
Dahlgren, Virginia 22448	
Attn: Experimental Officer	1

DISTRIBUTION LIST (Cont'd)

	Copies
Commander Naval Weapons Center China Lake, California 93555 Attn: Technical Library	1
Commander Naval Undersea Warfare Center 3202 E. Foothill Boulevard Pasadena, California 91107	1
Director Naval Research Laboratory Washington, D. C. 20390	2
Commanding Officer and Director Naval Ship Research & Development Center Washington, D. C. 20007 Attn: Library	1
Dr. W. W. Murray	1
Commanding Officer & Director Underwater Explosions Research Division Naval Ship Research & Development Center Portsmouth, Virginia 23709	1
Superintendent U. S. Naval Postgraduate School Monterey, California 93940	1
Commander Naval Undersea Warfare Center San Diego Division 271 Catalina Boulevard San Diego, California 92152	1
Commanding Officer U. S. Naval Underwater Weapons Research & Engineering Station Newport, Rhode Island 02840	1
Commander U. S. Naval Weapons Station Yorktown, Virginia 23491 Attn: Research & Development Division	1
Commanding Officer Naval Torpedo Station Keyport, Washington 98345	1
Commanding Officer U. S. Navy Underwater Sound Laboratory Fort Trumbull New London, Connecticut 06321	1

DISTRIBUTION LIST (Cont'd)

	Copies
Commanding Officer U. S. Naval Air Development Center Johnsville, Pennsylvania 18974	1
Commander U. S. Naval Oceanographic Office Washington, D. C. 20390	1
Commanding Officer U. S. Navy Mine Defense Laboratory Panama City, Florida 32402	1
Commanding Officer Naval Civil Engineering Laboratory Port Hueneme, California 93041	1
Commanding Officer U. S. Naval Weapons Evaluation Facility Kirtland Air Force Base Albuquerque, New Mexico 87117	1
Chief of Research & Development Department of the Army Washington, D. C. 20310	2
Commanding General Material Command Headquarters Department of the Army Washington, D. C. 20315	2
Chief of Engineers Department of the Army Washington, D. C. 20315 Attn: ENGNB	2
ENGEB	1
Commanding Officer U. S. Army Mobility Equipment R&D Center Fort Belvoir, Virginia 21060	2
Director Waterways Experiment Station Vicksburg, Mississippi 39181 Attn: Technical Library	1
G. L. Arbuthnot	1
J. N. Strange	1
Commanding General Ballistic Research Laboratories Aberdeen, Maryland 21005	1

DISTRIBUTION LIST (Cont'd)

	Copies
Commanding Officer Picatinny Arsenal Dover, New Jersey 07801	1
Commanding Officer USA Signal R&D Laboratory Fort Monmouth, New Jersey 07703 Attn: Technical Documents Center	1
Commanding Officer Nuclear Defense Laboratory Edgewood, Maryland 21010	1
Chief AF Technical Applications Center 2525 Telegraph Road Alexandria, Virginia 22300	1
Commander (OOAMA) Hill Air Force Base Ogden, Utah 84401 Attn: Ammunition Services Office	1
Commander (PGTRI) Air Proving Ground Center Eglin Air Force Base, Florida 32542	1
Commander Norton Air Force Base San Bernadina, California 92409 Attn: BSRAA	1
Commander Air Force Weapons Laboratory Kirtland Air Force Base Albuquerque, New Mexico 87117 Attn: Technical Library	1
Director Defense Research & Engineering Washington, D. C. 20310 Attn: Technical Library	1
Director Applied Physics Laboratory Johns Hopkins University Silver Spring, Maryland 20910	1
Director Defense Atomic Support Agency Washington, D. C. 20305	2

DISTRIBUTION LIST (Cont'd)

	Copies
Director Applied Physics Laboratory University of Washington Seattle, Washington 98105	1
Director Ordnance Research Laboratory Pennsylvania State University University Park, Pennsylvania 16802	1
Director Woods Hole Oceanographic Institution Woods Hole, Massachusetts 02543	1
Director Scripps Institute of Oceanography La Jolla, California 92037	1
Chief of Naval Material Washington, D. C. 20360 Attn: NMAT-03	1
DPL-NMAT-03L	1
NMAT-0312D	1
Director Lawrence Radiation Laboratory University of California Livermore, California 90024 Attn: Technical Information Division	2
Director Los Alamos Scientific Laboratory University of California P. O. Box 1663 Los Alamos, New Mexico 87544 Attn: Dr. D. P. MacDougall	2
NASA Scientific & Technical Information Facility P. O. Box 33 College Park, Maryland 20740	1
Sandia Corporation Sandia Base Albuquerque, New Mexico 87103 Attn: Classified Document Division	1
Sandia Corporation P. O. Box 969 Livermore, California 94551	1

DISTRIBUTION LIST (Cont'd)

	Copies
URS Corporation 1811 Trousdale Drive Burlingame, California 94011 Attn: Kenneth Kaplan Deputy Director	1
Defense Documentation Center Cameron Station Alexandria, Virginia 22314 Attn: TIPDR	20
Chief of Naval Material U. S. Naval Ordnance Laboratory White Oak, Silver Spring, Maryland 20910 Attn: ASW-900 (A. Solem)	1
Commanding Officer Naval Weapons Center Corona Laboratories Corona, California 91720	1
Underwater Systems, Incorporated World Building, Room B-10 8121 Georgia Avenue Silver Spring, Maryland 20910 Attn: Dr. Marvin S. Weinstein	1
Commanding Officer SEAL Team Two Amphibious Force U. S. Atlantic Fleet U. S. Naval Amphibious Base Norfolk, Virginia 23512	1

UNCLASSIFIED

Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) U. S. Naval Ordnance Laboratory White Oak, Silver Spring, Maryland 20910	2a. REPORT SECURITY CLASSIFICATION Unclassified 2b. GROUP

3. REPORT TITLE

Comparison of the Underwater Power of Explosives in Small Charges XII. The Effect of Particle Size and Density on the Performance of Composite Explosives

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

5. AUTHOR(S) (First name, middle initial, last name)

Thomas B. Heathcote

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
2 December 1968	iii & 8	5

8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S) NOLTR 68-184
b. PROJECT NO ORDTASK No. ORD-332-006/UF17-354-304	
c.	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)
d.	

10. DISTRIBUTION STATEMENT

Each transmittal of this document outside the agencies of the U. S. Government must have prior approval of NOL.

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
	Naval Ordnance Systems Command

13 ABSTRACT

Three composite explosives pressed to several densities were used to study the effects of particle size and density on explosive output from 1-lb charges. Use of coarse grade ammonium perchlorate produced an explosive output dependent on charge density; no such effect was observed with fine ammonium perchlorate. TNT/Al/Wax charges gave output greater than that estimated for large charges.

DD FORM 1 NOV 65 1473 (PAGE 1)

S/N 0101-807-6801

UNCLASSIFIED

Security Classification

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Underwater Explosions						
Composite Explosives						
Small Charges						
Ammonium Perchlorate						
TNT						